DYNAMIC CRACK PROPAGATION IN THIN-WALLED STRUCTURES

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A cohesive interface element is presented for the finite element analysis of dynamic fracture in thin specimens. In particular, the development is intended for scenarios where the material is modeled with 3D shell elements. In traditional cohesive interface elements, cohesive laws relate the tensile and shear traction with the normal and tangential interface separation computed only from the nodal displacements [1-3]. In the case of interface elements connecting shell, special care must be taken to properly consider the nodal rotations. Zero-thickness interface elements are embedded between shell elements to describe crack initiation and evolution. A bending moment-rotation relation is included in the cohesive formulation to transmit the moment and describe the initiation and propagation of cracks growing through the thickness of the shell elements. Since crack initiation and evolution are a natural outcome of the cohesive zone model without the need of any ad-hoc fracture criterion, this model results in essentially automatic predictions of fracture. This approach has been implemented in Dyna3D for shell elements and it could be used to simulate brittle and ductile crack propagation for many applications involving complicated failure modes in thin films, sheet metals and any other shell-like structure. Especially for those cases involving Mode I/III, bending and folding. The model is validated by several examples.

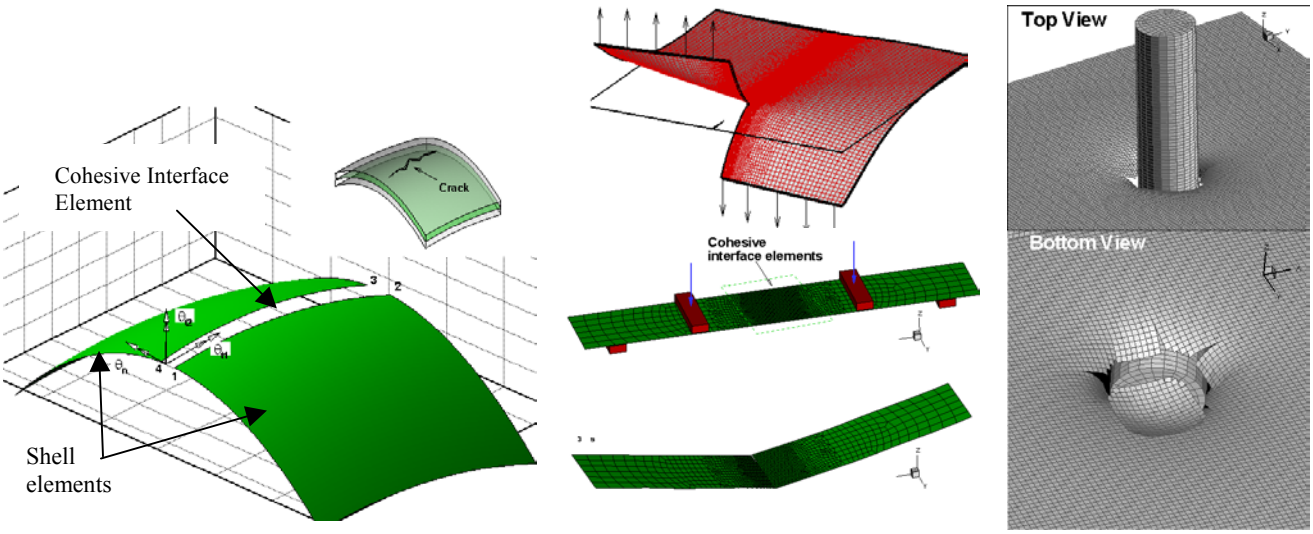

Figure 1: Schematics and examples of the interface cohesive element for shell elements.

References

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